US009187869B2

(12) **United States Patent**
Rainey

(10) **Patent No.: US 9,187,869 B2**
(45) **Date of Patent: Nov. 17, 2015**

(54) **PRECAST LEVELING SEGMENT BELOW A TRAFFIC BARRIER ATOP AN EARTH RETAINING WALL SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/177,342**

(22) Filed: **Feb. 11, 2014**

(65) **Prior Publication Data**

US 2014/0234025 A1 Aug. 21, 2014

Related U.S. Application Data

(60) Provisional application No. 61/766,794, filed on Feb. 20, 2013, provisional application No. 61/914,127, filed on Dec. 10, 2013.

(51) **Int. Cl.**
E01F 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***E01F 15/083*** (2013.01)

(58) **Field of Classification Search**
CPC E01F 15/083; E01F 15/146; E01F 15/02; E01F 13/12
USPC 404/6
See application file for complete search history.

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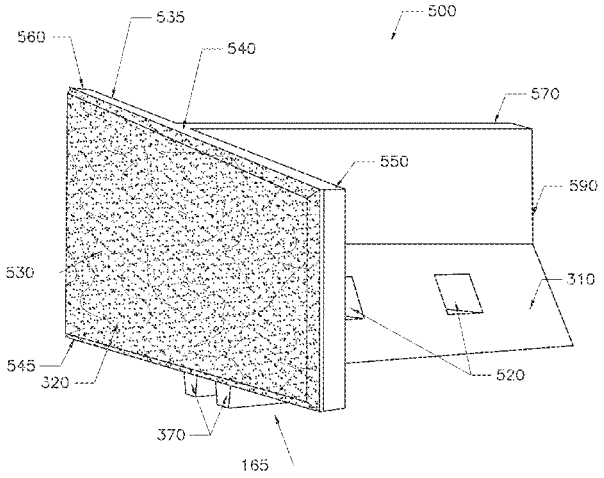
(74) *Attorney, Agent, or Firm* — Thomas | Horstemeyer, LLP

(57) **ABSTRACT**

Disclosed herein are embodiments of a roadside barrier segment to sit on top of a retaining wall to provide impact resistance to vehicular traffic. Concrete traffic barriers are pre-cast in a controlled manufacturing environment then transported as a modular precast concrete segment to the jobsite and installed interlocking directly on top of an earth retaining wall. The precast concrete segment is designed to have a counterweight from soil backfill on a stem of the precast segment that resists overturning pressures from vehicle impact on the traffic barrier segment that extends above the roadway surface. The stem may be triangular in shape to capture more of the backfill soil. A vertical node may be placed on one side of the segment and a receiving channel on the opposite side of the segment to allow the interaction of adjacent segments to share impact loads from motor vehicles.

18 Claims, 16 Drawing Sheets



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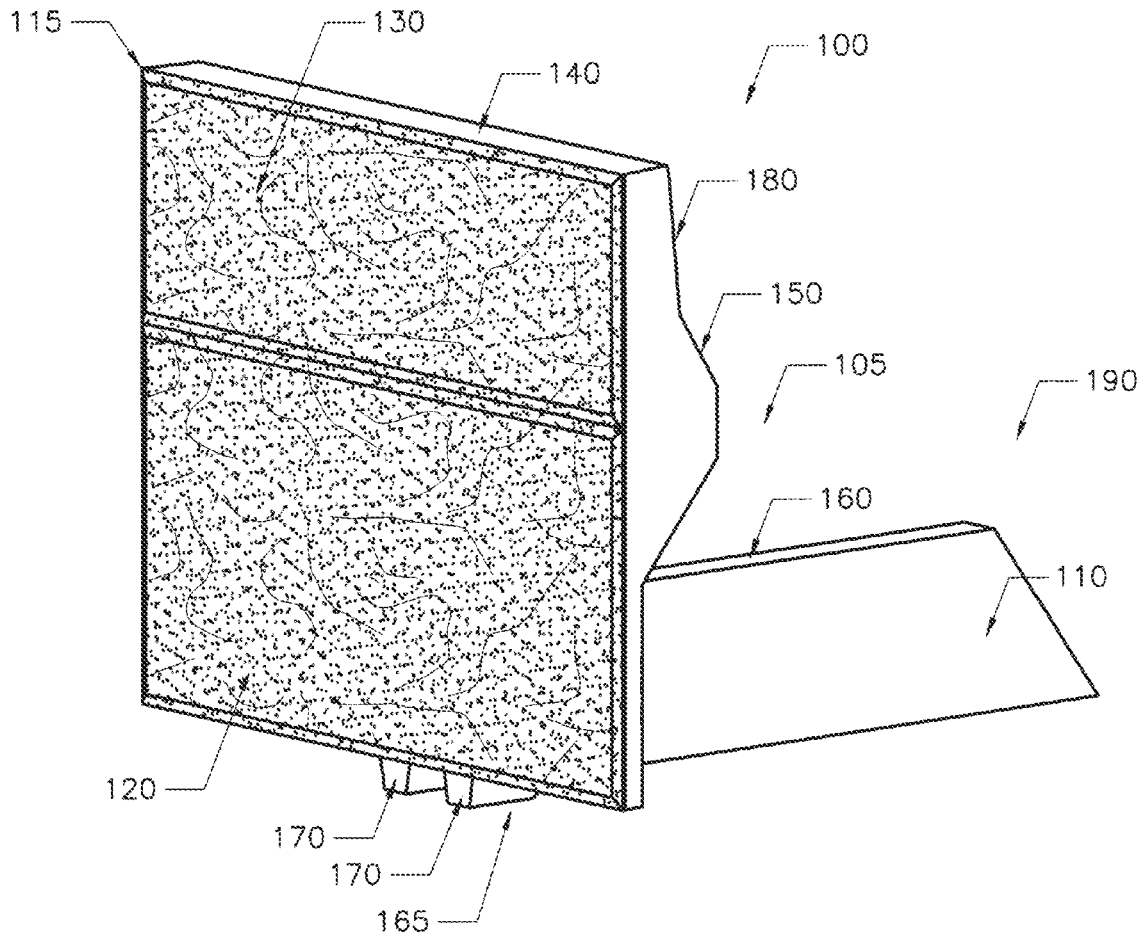

FIGURE 1

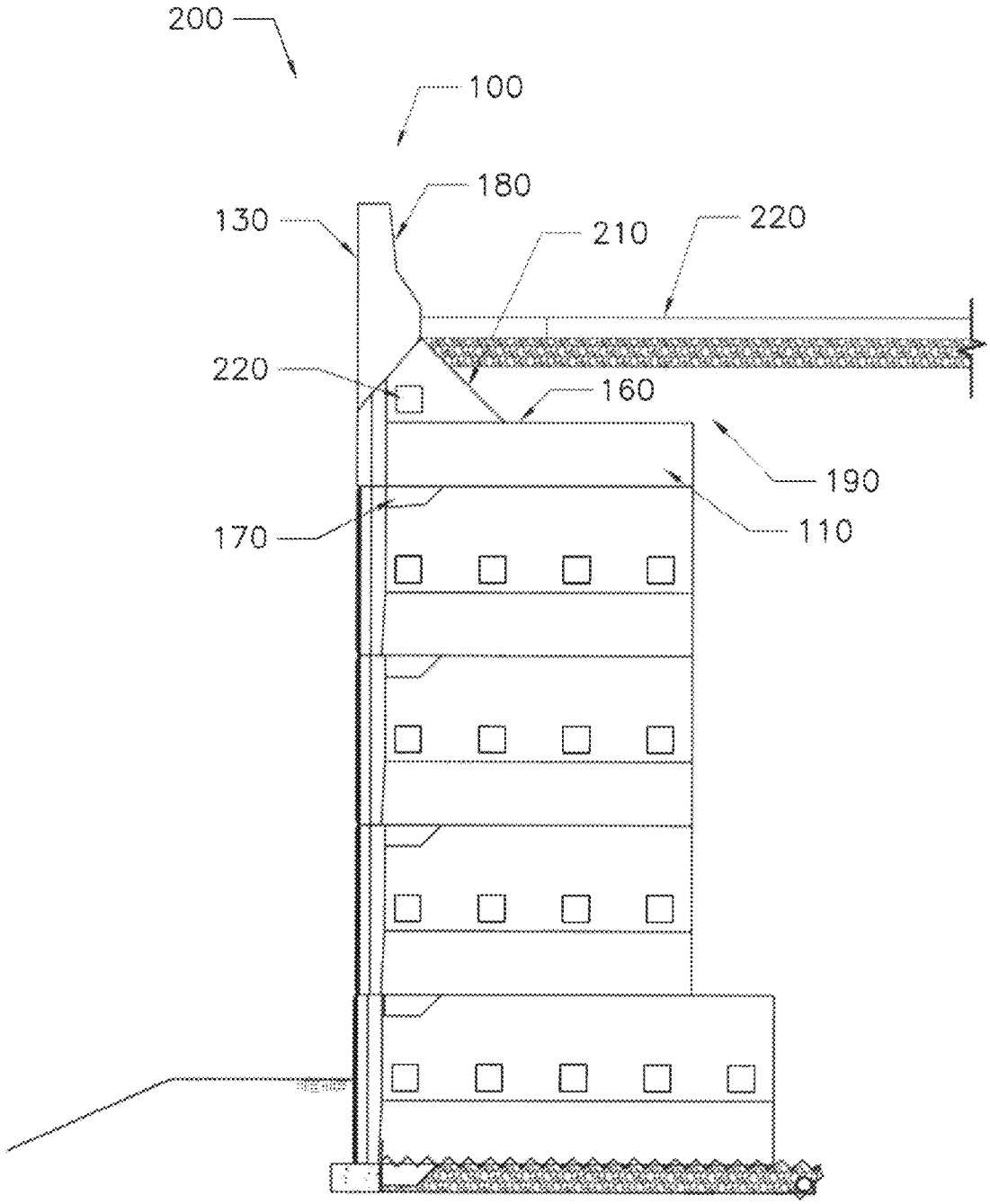

FIGURE 2

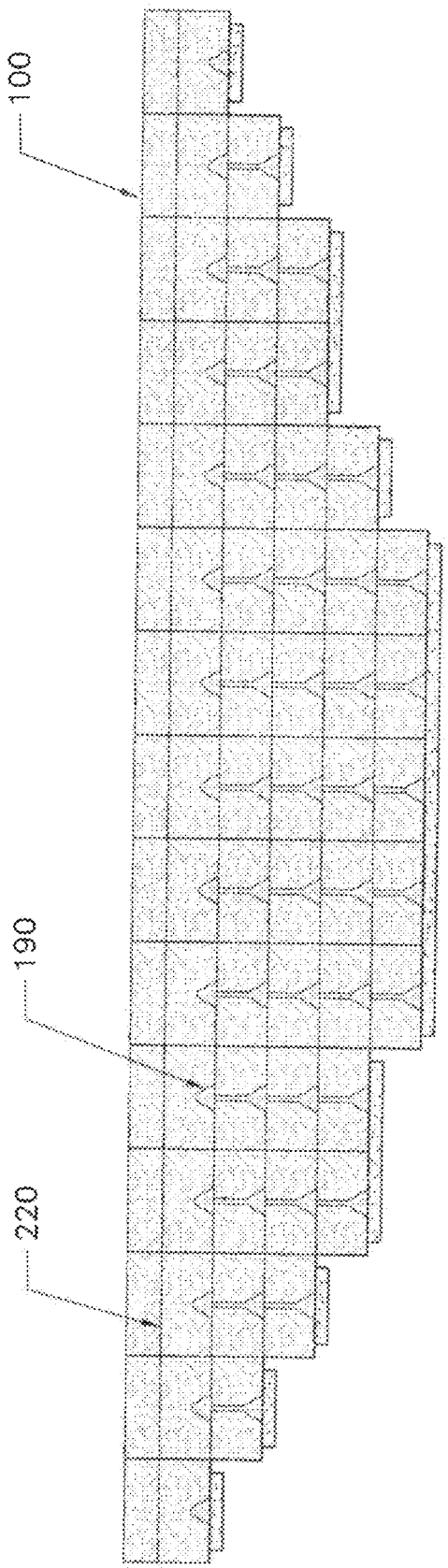

FIGURE 3

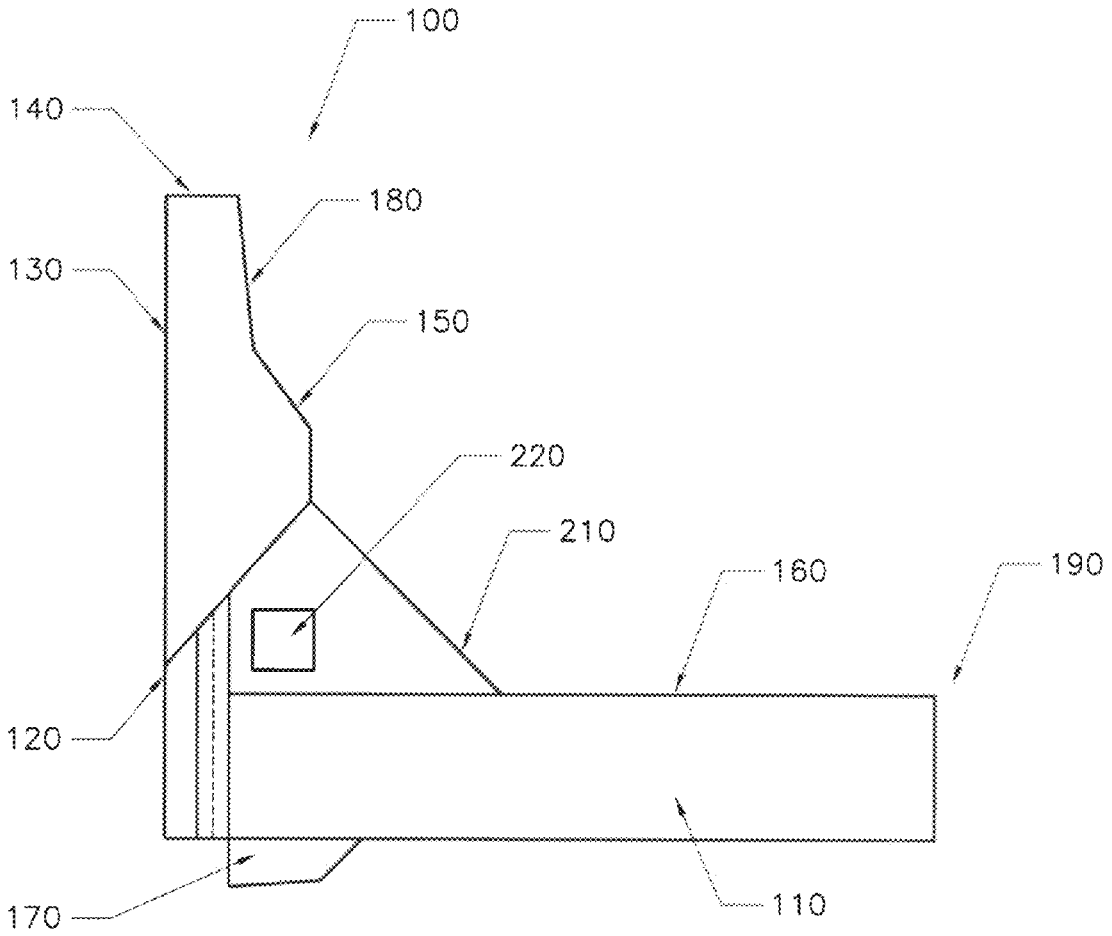

FIGURE 4

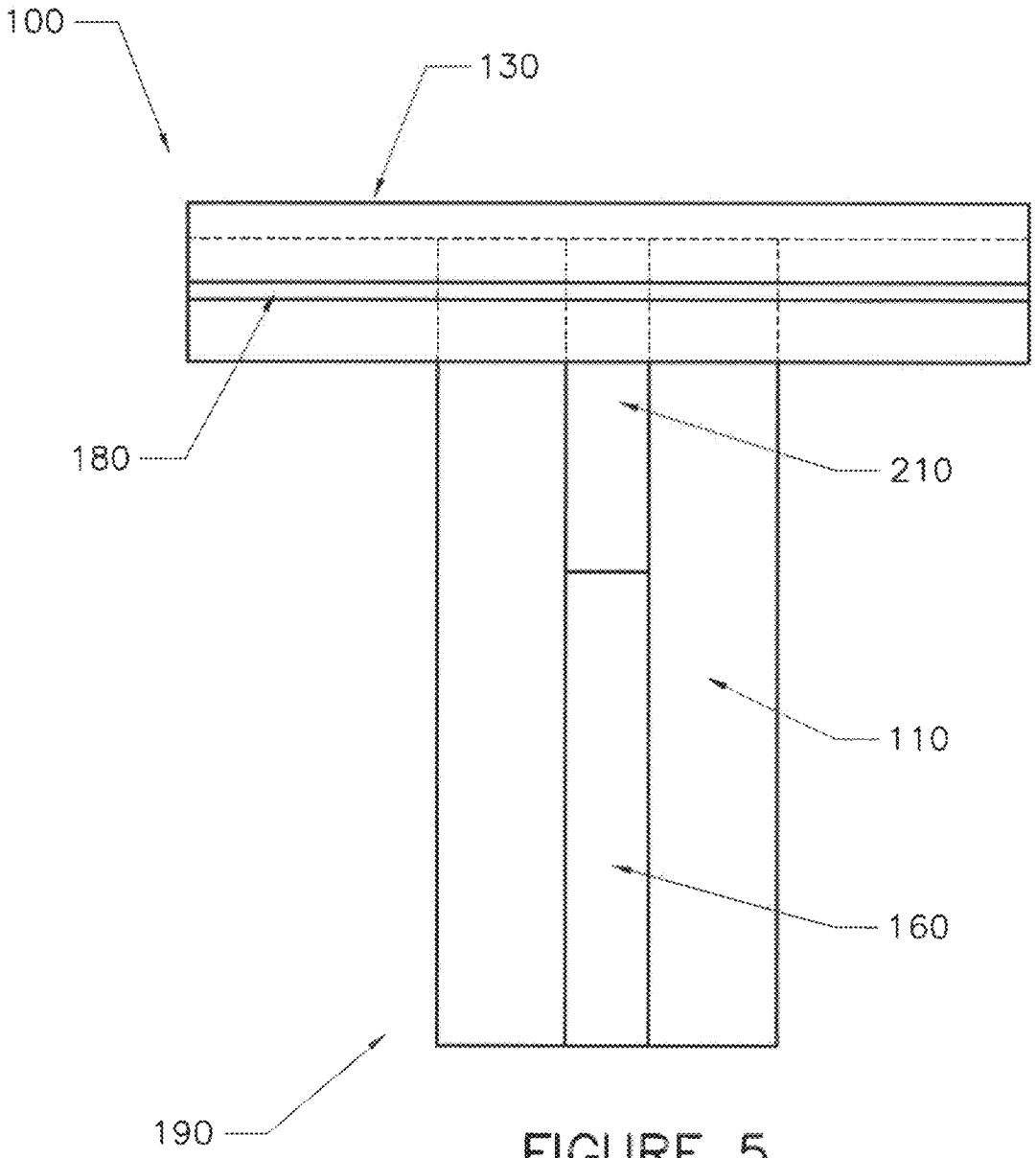

FIGURE 5

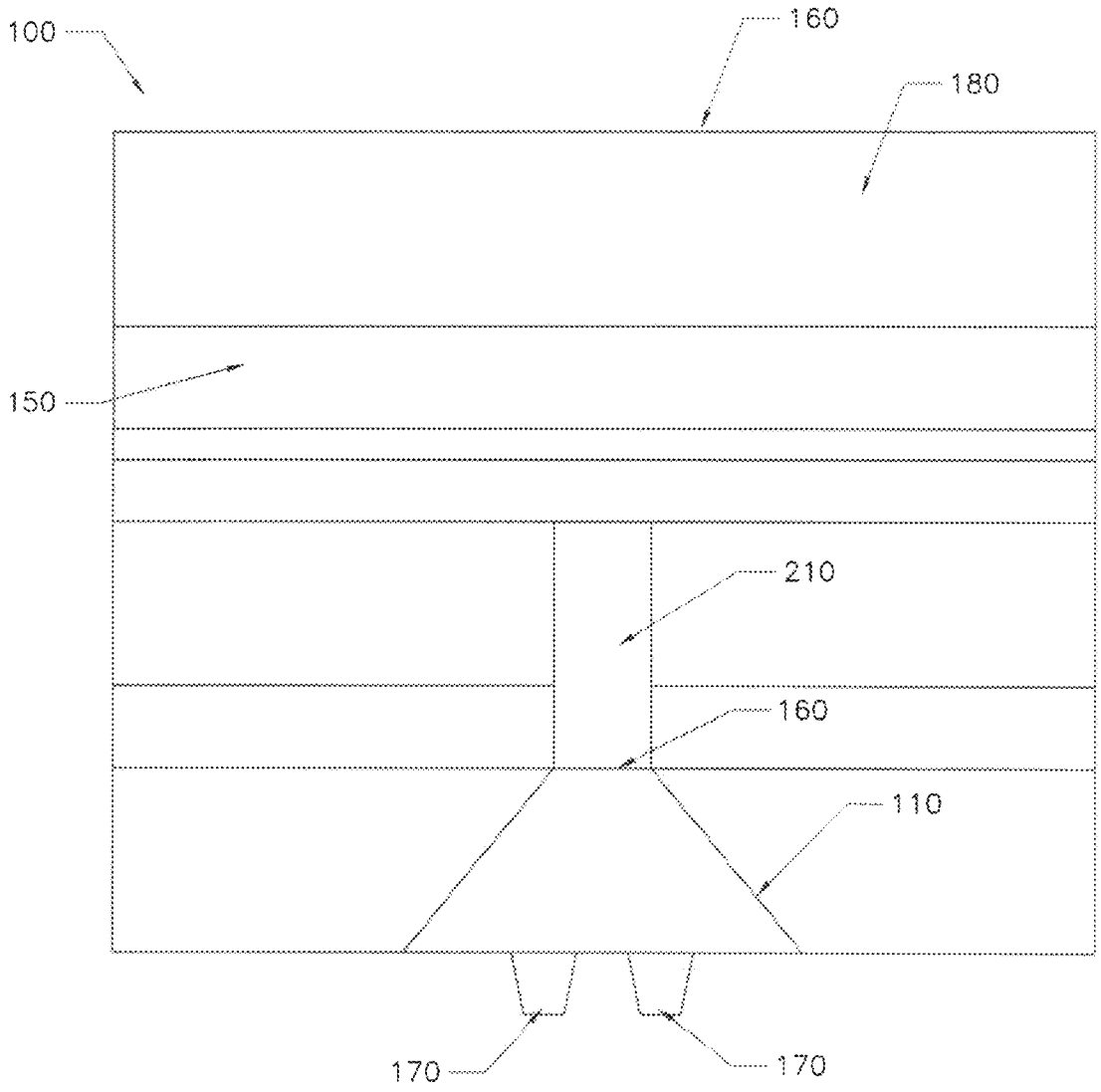

FIGURE 6

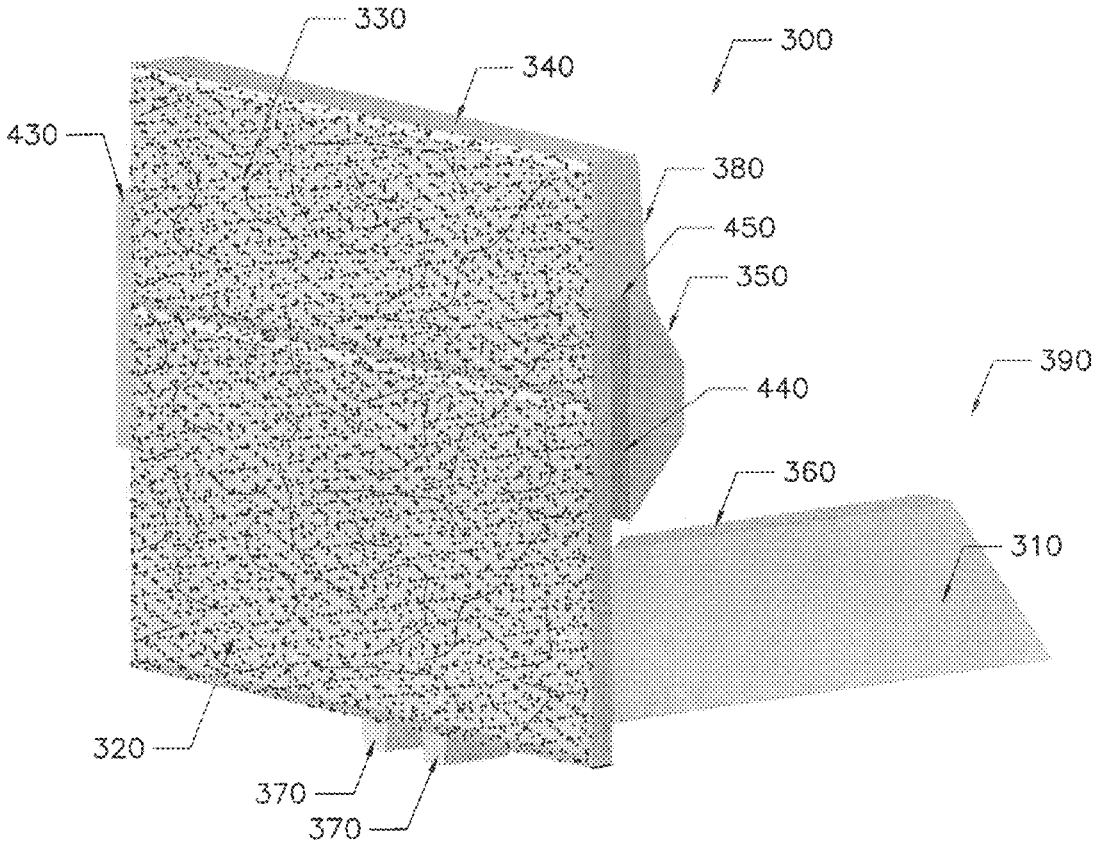

FIGURE 7

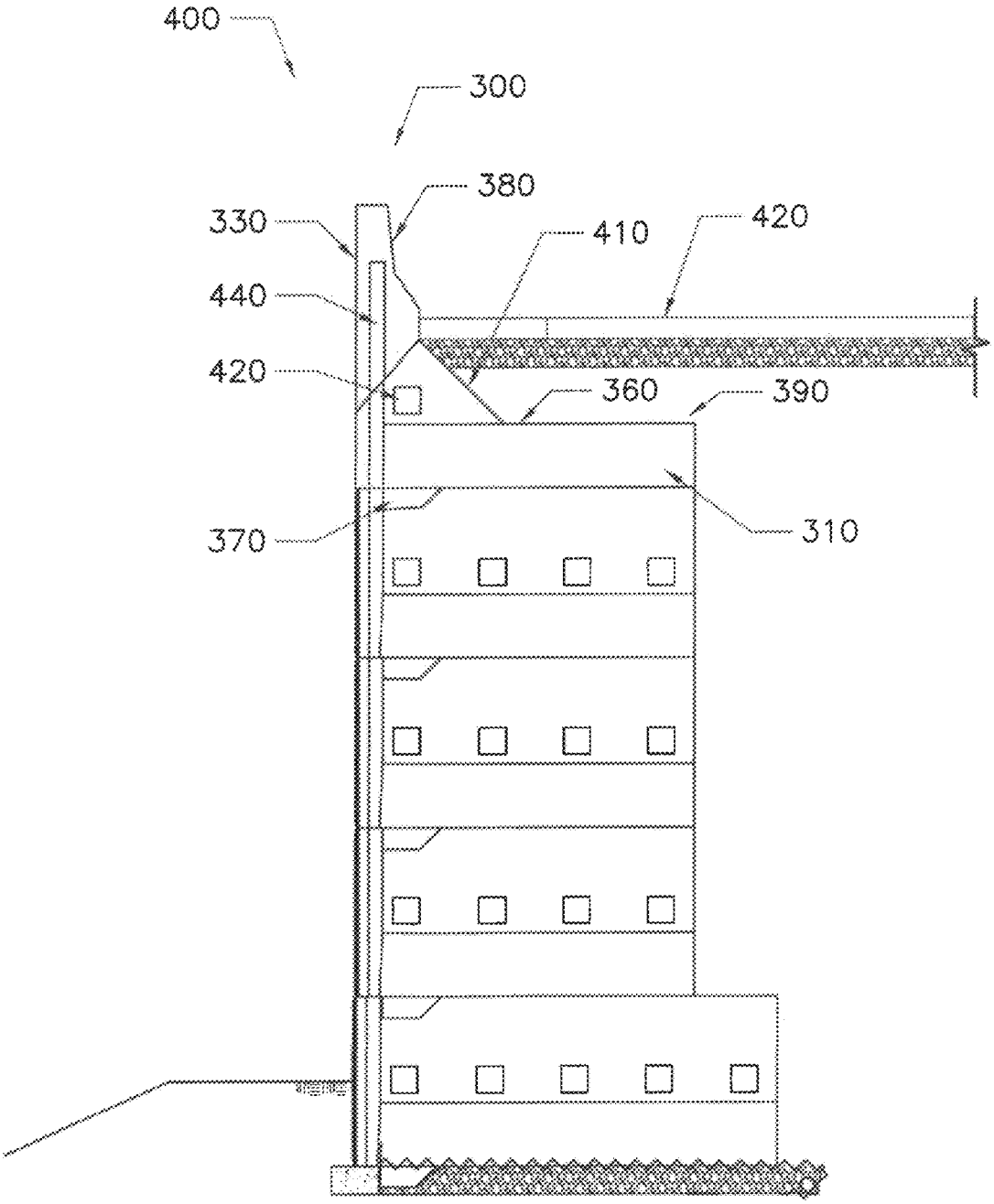

FIGURE 8

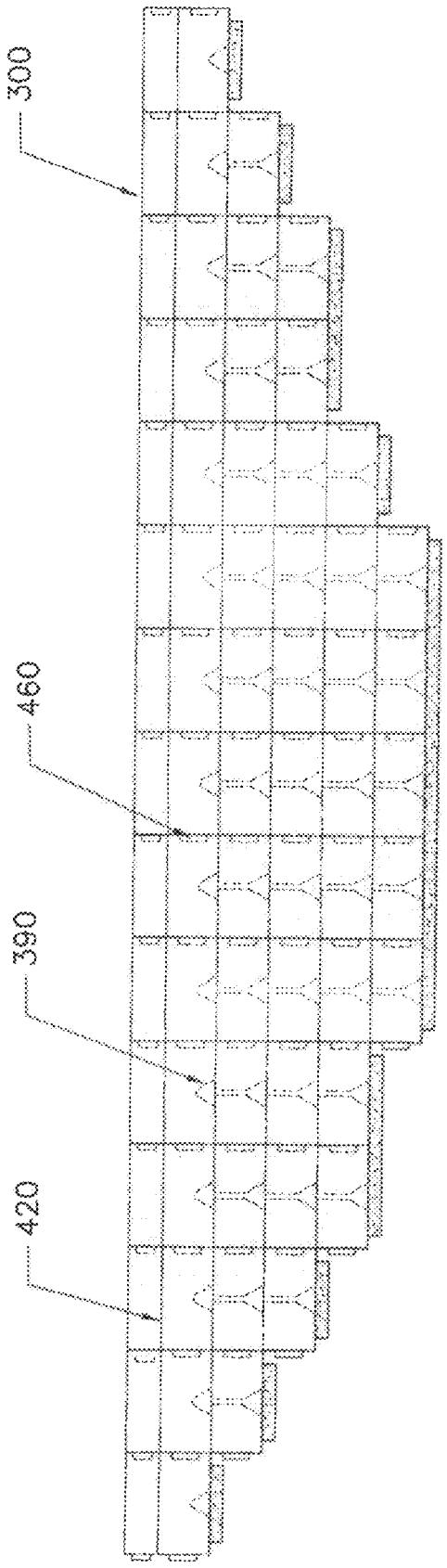

FIGURE 9

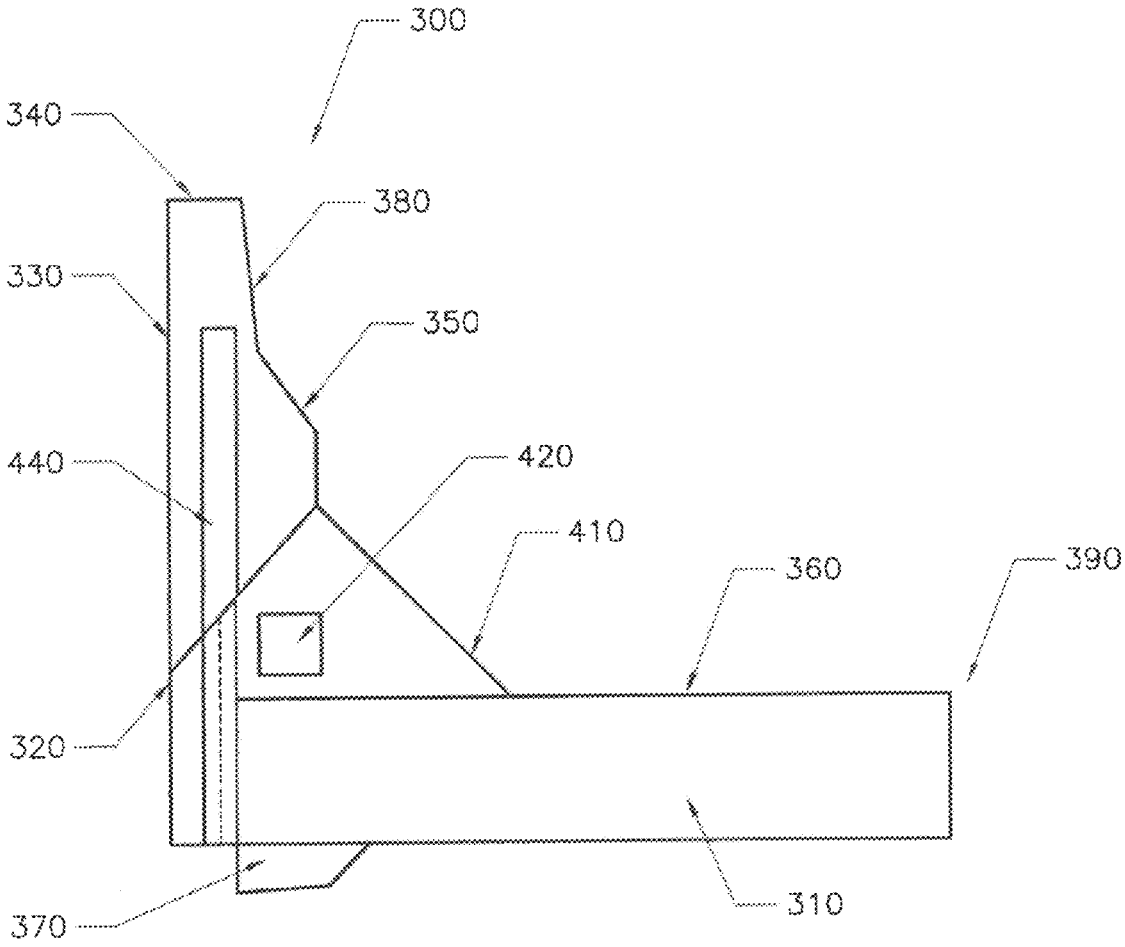

FIGURE 10

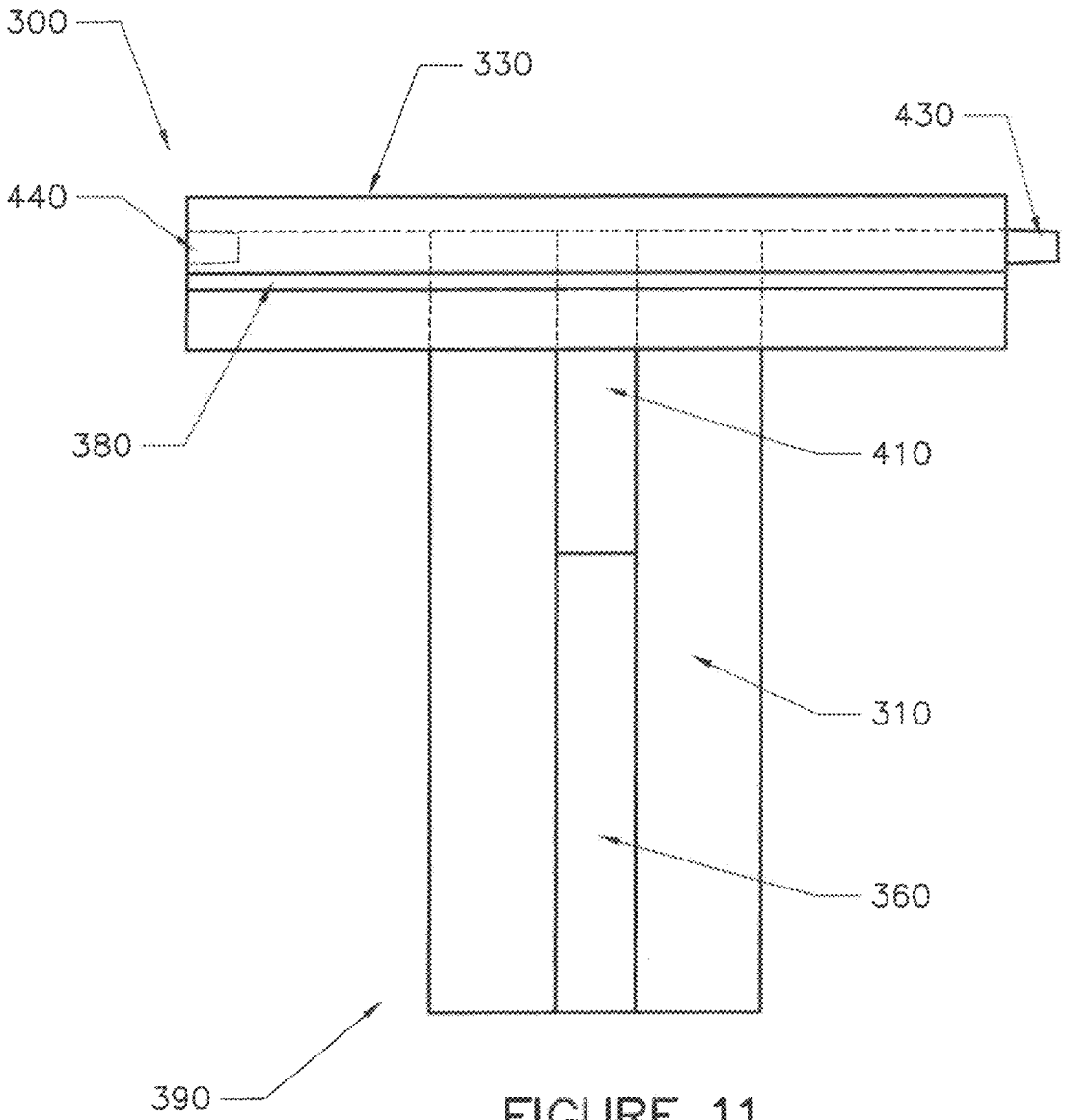

FIGURE 11

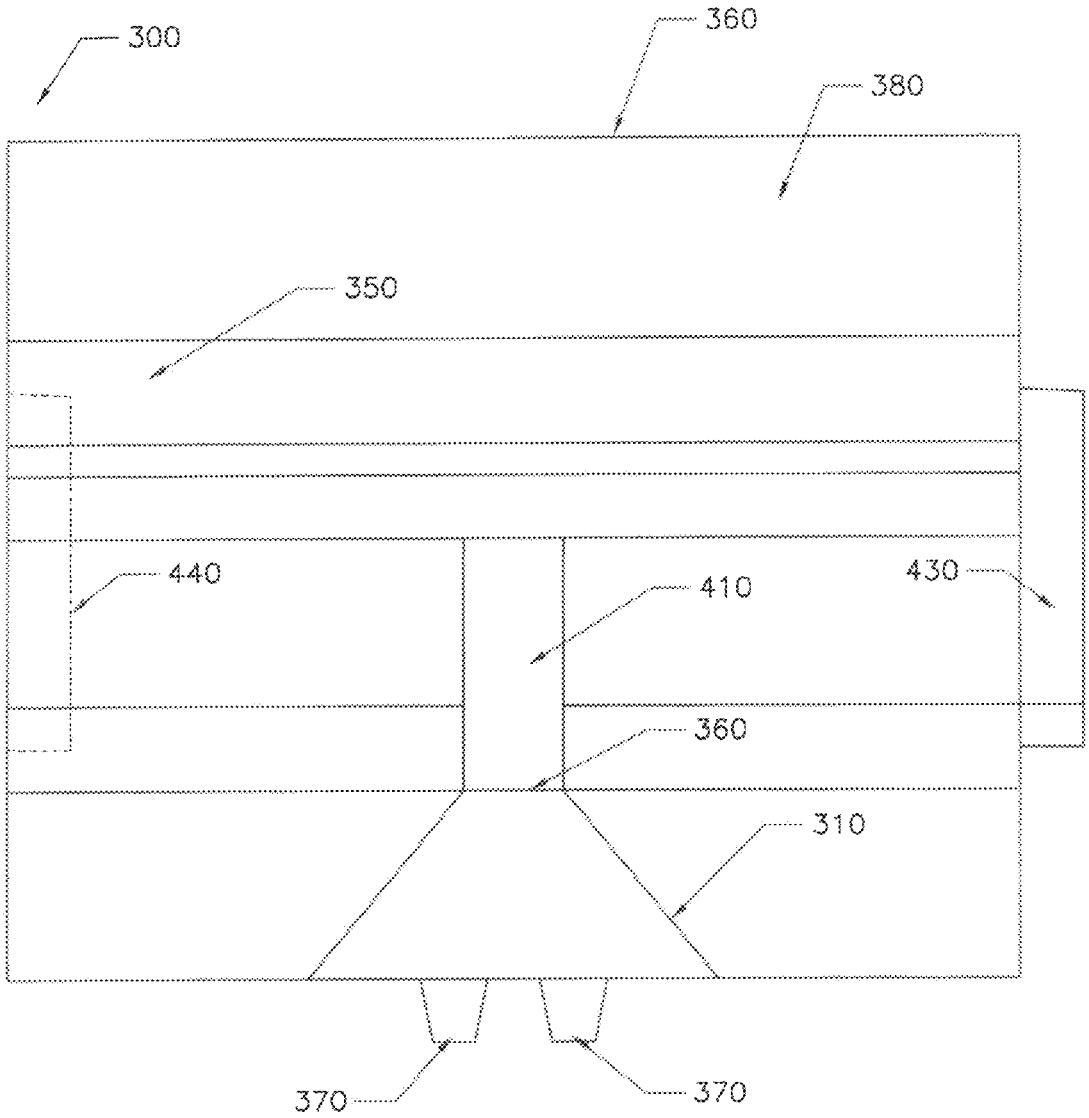

FIGURE 12

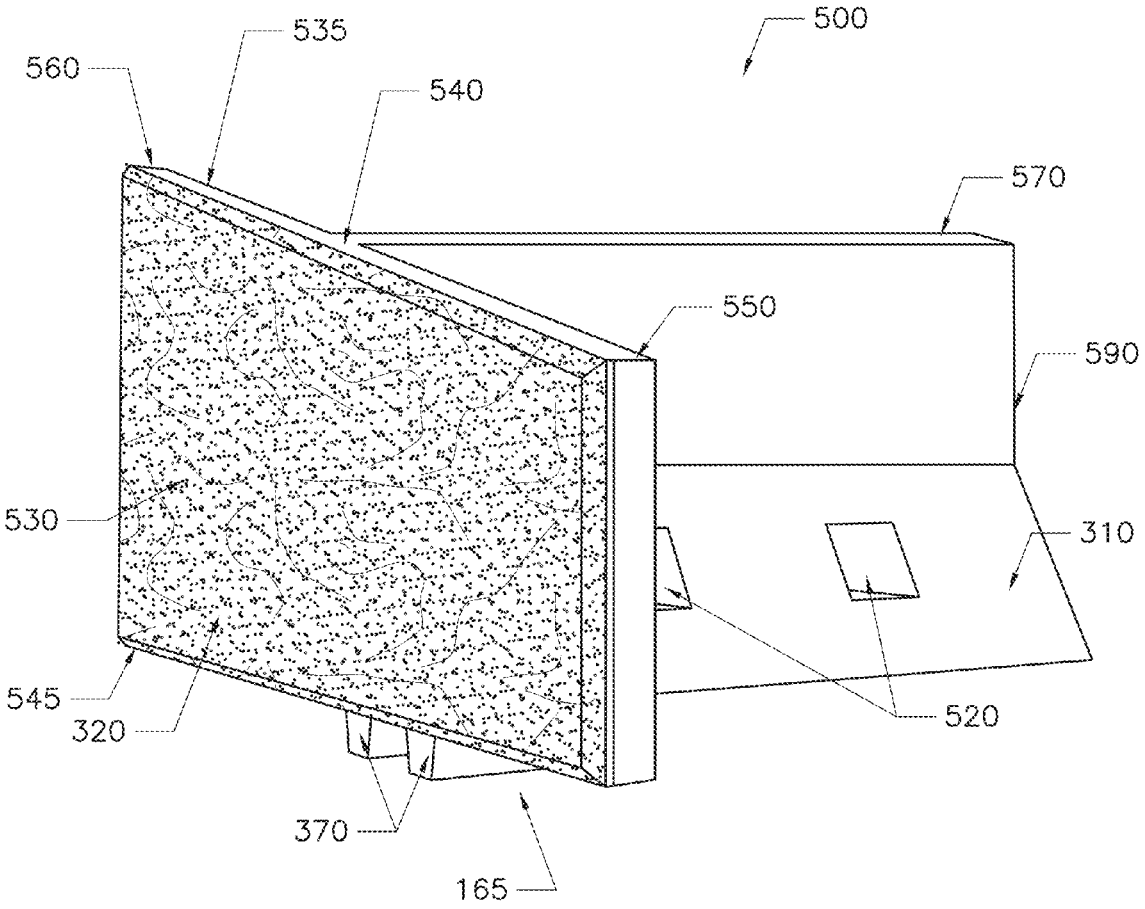

FIGURE 13

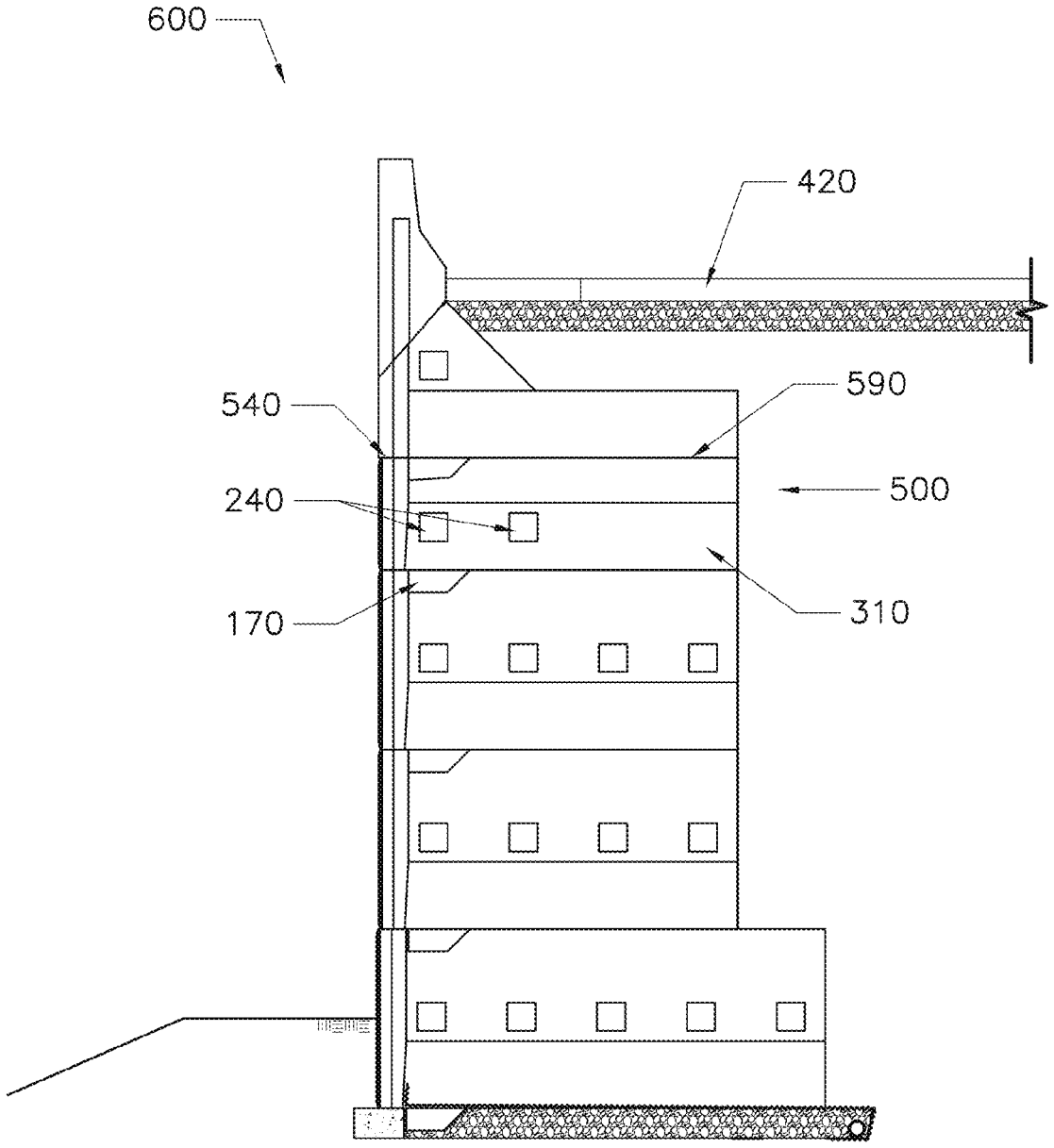

FIGURE 14

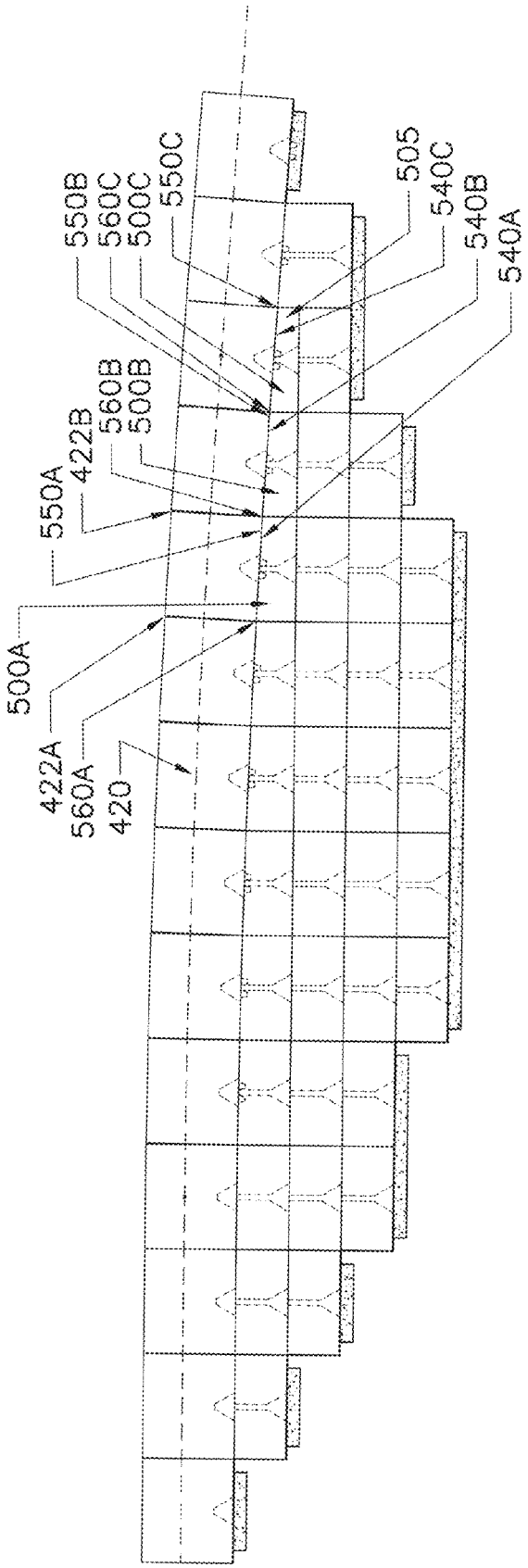
550B
560C
500C
550C
505
540C
540B
540A
560B
500B
422B
550A
500A
422A
560A
420

FIGURE 15

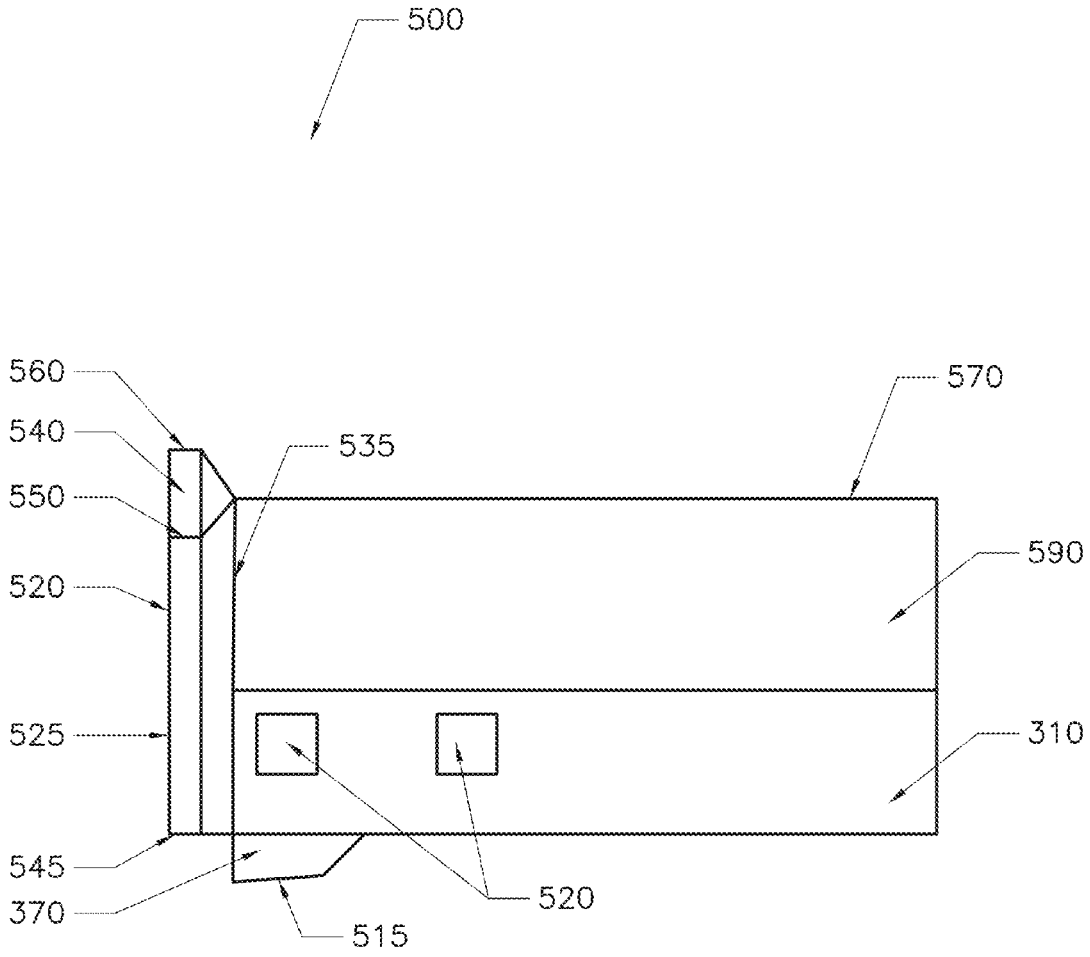

FIGURE 16

PRECAST LEVELING SEGMENT BELOW A TRAFFIC BARRIER ATOP AN EARTH RETAINING WALL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. provisional application entitled, "Precast Traffic Barrier Segment Atop Retaining Wall System," having application No. 61/766,794, filed Feb. 20, 2013, and U.S. provisional application entitled, "Precast Leveling Segment Below a Traffic Barrier Atop an Earth Retaining Wall System," having application No. 61/914,127, filed Dec. 10, 2013, and, both of which are entirely incorporated herein by reference.

BACKGROUND

Precast concrete earth retaining walls are commonly used for architectural, site development and roadway/highway construction applications. When roadways are located above or rest on top of the completed earth retaining wall, a traffic barrier segment is required to prevent vehicles from falling off of the retaining wall. Therefore, a traffic barrier segment is required to contain the impact from vehicles to keep them from falling over the retaining wall.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a view of the exemplary precast traffic barrier segment in accordance various first embodiments of the disclosure;

FIG. **2** is a cross sectional view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. **1** sitting on top of an earth retaining wall in accordance various embodiments of the disclosure;

FIG. **3** is an elevation view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. **1** making up the top row of precast concrete segments in accordance various embodiments of the disclosure;

FIG. **4** is a side view of the exemplary precast traffic barrier segment of FIG. **1** in accordance various embodiments of the disclosure;

FIG. **5** is a top view of the exemplary precast traffic barrier segment of FIG. **1** in accordance various embodiments of the disclosure;

FIG. **6** is a back view of the exemplary precast traffic barrier segment of FIG. **1** in accordance various embodiments of the disclosure.

FIG. **7** is a view of the exemplary precast traffic barrier segment that interact with adjacent segments in accordance various second embodiments of the disclosure;

FIG. **8** is a cross sectional view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. **7** that interact with adjacent segments sitting on top of an earth retaining wall in accordance various embodiments of the disclosure;

FIG. **9** is an elevation view of an earth retaining wall with the exemplary precast traffic barrier segment of FIG. **7** that interact with adjacent segments making up the top row of precast concrete segments in accordance various embodiments of the disclosure;

FIG. **10** is a side view of the exemplary precast traffic barrier segment of FIG. **7** that interact with adjacent segments in accordance various embodiments of the disclosure;

FIG. **11** is a top view of the exemplary precast traffic barrier segment of FIG. **7** that interact with adjacent segments in accordance various embodiments of the disclosure;

FIG. **12** is a back view of the exemplary precast traffic barrier segment of FIG. **7** that interact with adjacent segments in accordance various embodiments of the disclosure

FIG. **13** is a view of the exemplary precast leveling segment in accordance various first embodiments of the disclosure;

FIG. **14** is a cross sectional view of an earth retaining wall with the exemplary precast leveling segment of FIG. **13** sitting as the top course of an earth retaining wall in accordance various embodiments of the disclosure and just underneath the traffic barrier course;

FIG. **15** is an elevation view of an earth retaining wall with the exemplary precast leveling segment of FIG. **13** making up the second from the top row of precast concrete segments in accordance various embodiments of the disclosure;

FIG. **16** is a side view of the exemplary precast leveling segment of FIG. **13** in accordance various embodiments of the disclosure.

DETAILED DESCRIPTION

Disclosed herein various embodiments of precast traffic barrier segments that are designed to rest above an earth retaining wall of precast segments to prevent traffic from falling over the retaining wall. The objective of the current invention is to allow a uniform height precast traffic barrier be installed parallel and to the alignment grade of the proposed roadway grade above the wall even though the supporting retaining wall is constructed and installed in parallel uniform height segments along courses of modular precast units. In order to provide a differing height required to follow a roadway grade that varies along the wall length especially in vertical curves of the changing roadway grade, a leveling or variable height course of modular concrete segment block units is required. The current invention, with the use of a tilting table to cast the leveling units at various heights/angles, modifies the immediate course below the uniform height traffic barrier course to allow the traffic barrier to follow the changing vertical grade of the roadway.

When roadways, driveways or vehicle access is planned above an earth retaining wall, a barrier to prevent traffic from falling over the walls leading edge is typically required. Traditionally, a guard rail or poured in place concrete traffic barrier segment is installed above the retaining wall to contain vehicles above the earth retaining wall in the planned drive isle or roadway. The exemplary embodiments expedite installation of the traffic barrier segment by making it a part of the earth retaining wall system where the barrier segment can act as the top row of modular precast retaining wall system and provide resistance to overturning by using the backfill soil weight resting on the horizontal triangular stem. The downward pressure of the soil backfill beside and on top of the horizontal stem provides the resisting pressure to have the exemplary precast traffic barrier segment act as a cantilever foundation/vertical wall and resist impact loads from vehicles on the portion of the barrier segment extending above grade.

Generally speaking, the portion of the traffic barrier segment extending above grade has a shape that varies depending upon a state's rules and regulations (promulgated by the

Department of Transportation), which define certain acceptable geometries and dimensions for barrier segments installed along roadways/highways of the state. Therefore, the geometry of the traffic barrier segment's vertical portion extending above roadway grade may vary from state to state.

First Embodiment(s)

Referring to FIG. **1**, an exemplary precast traffic barrier segment **100** has a vertical face **130** that extends above roadway grade and a face **120** extending below roadway grade that consists of the upper portion of the underlying earth retaining wall. The top of the barrier segment portion **140** above roadway grade is typically 32 inches above the roadway or driveway surface elevation. The back face of the barrier segment extending above grade is 180 where the vehicular impact would occur as well as the slanted portion **150**. The overall stability of the exemplary precast traffic barrier segment is prevented from overturning by a counterweight from backfill soil resting beside and above the rear stem **190**. A triangular portion **110** of the rear stem helps capture the surrounding backfill soils weight to add resisting force by means of downward weight on the exemplary traffic barrier segment stem **190**. The top of the stem **160** is approximately 30 inches below the drive or roadway grade to allow the installation of utilities and pavement section not obscured by the precast traffic barrier segment piece or segment.

FIG. **2** shows a cross section **200** of the elevated roadway grade **220** sitting on top of the earth retaining wall. The stem **190** of the exemplary precast traffic barrier segment sits well below the pavement grade **220** to prevent interference. To keep the exemplary precast traffic barrier segment from sliding on top of the retaining wall, two protruding lugs **170** extend below the exemplary traffic barrier segment to lock into the top concrete precast segment of the earth retaining wall. For installation of the exemplary precast traffic barrier segment, a square hole **240** is cast into the exemplary precast traffic barrier segment to facilitate lifting and hoisting into place. A diagonal portion of the stem **210** is required to transfer the downward cantilever pressure on the stem **190** to the vertical portion of the exemplary precast traffic barrier segment to prevent impact on the face **120** of the barrier segment facing vehicular traffic.

In looking at an elevation view, FIG. **3**, of the front face of the earth retaining wall, the exemplary precast traffic barrier segment **100** makes up the top row of the concrete earth retaining wall to complete or top out the earth retaining wall soil retention requirements. The grade of the proposed roadway **220** is below the barrier segment portion of the precast traffic barrier segment but above the stem portion **190** of the traffic barrier segment.

In FIG. **4**, the exemplary precast traffic barrier segment **100** is shown to illustrate the unique features. The lower locking lugs **170** extend below the bottom of the stem **190** to lock into the earth retaining wall system below. The front face **120** of the precast traffic barrier segment is in vertical alignment with the underlying retaining wall face to complete the earth retaining wall vertical plane alignment. FIG. **5** shows the top view to illustrate the triangular sides **110** of the stem **190** cover approximately 50% of the overall counterweight area of backfill soil that is available to provide weight for overturning resistance. The triangular stem portions **110** allow the reduced horizontal coverage area and hence save precast concrete area/volume.

FIG. **6** is a rear view of the exemplary precast traffic barrier segment **100** which shows the diagonal connection arm **210** from the top of the stem **160** up to the vertical portion of the traffic barrier segment **180** and **150**.

It should be emphasized that the above described invention of the present disclosure is to implement an arching effect within the earth retaining wall backfill soils by the triangular stem to take advantage of the soil backfill vertical weight to provide resisting force from horizontal vehicular impact on the portion of the stem above the drive isle or roadway grade. The dimensions of the portion of the barrier segment above grade may vary depending upon various Department of Transportation guidelines for impact barrier segments along roadways.

Second Embodiment(s)

When roadways are located above or rest on top of the completed earth retaining wall, a traffic barrier segment may be required to handle large impact loads from trucks or other large vehicles. The results may be more pressure than the individual segments can resist from overturning and sliding. Therefore, the attachment of one segment to the next horizontally in order to share the impact load may be required. In this instance, a groove is cast in the side of the segment with a slip joint to allow the segments to work together in resisting the impact.

The exemplary embodiment allows the individual segments to carry more impact load by interacting with the adjacent segments to provide more resistance than any one segment can exhibit alone. Also, the grove is such that when setting the segments in place, the adjacent segment slides down over the top to expedite installation of these traffic barrier segments. Also, the groove allows the alignment of the segments to be kept in line so the segments do not protrude out from one another that could snag a vehicle that comes in contact with the wall and slides down the traffic barrier segment impacting several segments in series.

Referring to FIG. **7**, the exemplary precast traffic barrier segment **300** has a vertical face **330** that extends above roadway grade and a face **320** extending below roadway grade that consists of the upper portion of the underlying earth retaining wall. The top of the barrier segment portion **340** above roadway grade is typically 36 inches above the roadway or driveway surface elevation. The back face of the barrier segment extending above grade is 380 where the vehicular impact would occur as well as the slanted portion **350**. The overall stability of the exemplary precast traffic barrier segment is prevented from overturning by a counterweight from backfill soil resting beside and above the rear stem **390**. A triangular portion **310** of the rear stem helps capture the surrounding backfill soils weight to add resisting force by means of downward weight on the exemplary traffic barrier segment stem **390**. The top of the stem **360** is approximately 30 inches below the drive or roadway grade to allow the installation of utilities and pavement section not obscured by the precast traffic barrier segment piece or segment. A vertical node **430** protrudes out the side of the segment to fit into the adjoining segments groove **440** to allow interconnectivity. The groove does not extend all the way to the top of the segment but terminates at **450** to not expose the joint and hide from view.

FIG. **8** shows a cross section **400** of the elevated roadway grade **420** sitting on top of the earth retaining wall. The stem **390** of the exemplary precast traffic barrier segment sits well below the pavement grade **420** to prevent interference. To keep the exemplary precast traffic barrier segment from sliding on top of the retaining wall, two protruding lugs **370** extend below the exemplary traffic barrier segment to lock into the top concrete precast segment of the earth retaining

wall. For installation of the exemplary precast traffic barrier segment, a square hole **420** is cast into the exemplary precast traffic barrier segment to facilitate lifting and hoisting into place. A diagonal portion of the stem **410** is required to transfer the downward cantilever pressure on the stem **390** to the vertical portion of the exemplary precast traffic barrier segment to prevent impact on the face **380** of the barrier segment facing vehicular traffic. The vertical slot **440** receives the adjacent vertical node **430** to interlock and allow connectivity and shared resistance when impacted.

In looking at an elevation view, FIG. **9**, of the front face of the earth retaining wall, the exemplary precast traffic barrier segment **300** makes up the top row of the concrete earth retaining wall to complete or top out the earth retaining wall soil retention requirements. The grade of the proposed roadway **420** is below the barrier segment portion of the precast traffic barrier segment, but above the stem portion **390** of the traffic barrier segment. The segments connect horizontally by a node and vertical channel **460** to share impact loads from vehicles.

In FIG. **10**, the exemplary precast traffic barrier segment **300** is shown to illustrate the unique features. The lower locking lugs **370** extend below the bottom of the stem **390** to lock into the earth retaining wall system below. The front face **320** of the precast traffic barrier segment is in vertical alignment with the underlying retaining wall face to complete the earth retaining wall vertical plane alignment. The vertical slot **440** is to receive the vertical node from the adjacent segment. FIG. **11** shows the top view to illustrate the triangular sides **310** of the stem **390** cover approximately 50% of the overall counterweight area of backfill soil that is available to provide weight for overturning resistance. The triangular stem portions **310** allow the reduced horizontal coverage area and hence save precast concrete area/volume. The vertical node **430** extends out the side of the segment to fit inside the adjacent segments vertical slot **440**.

FIG. **12** is a rear view of the exemplary precast traffic barrier segment **300** which shows the diagonal connection arm **410** from the top of the stem **360** up to the vertical portion of the traffic barrier segment **380** and **350**. The vertical node **430** is shown as well as the receiving vertical slot or channel **440**.

It should be emphasized that the second embodiment implements an arching effect within the earth retaining wall backfill soils by the triangular stem to take advantage of the soil backfill vertical weight to provide resisting force from horizontal vehicular impact on the portion of the stem above the drive isle or roadway grade. The dimensions of the portion of the barrier segment above grade may vary depending upon various Department of Transportation guidelines for impact barrier segments along roadways. The vertical node on one side and vertical slot or channel on the opposite side allows horizontal interaction of adjacent segments to share vehicle impact loads.

Third Embodiment(s)

Referring to FIG. **13**, shown is an exemplary precast leveling segment **500**. The precast leveling segment **500** has a front portion **320**, horizontal stem **590**, and an alignment seat **165**. The front portion **320** comprises a front surface **530**, a rear surface **535**, a top surface **540**, and a bottom surface **545**. The top surface **540** may slope in parallel to an above roadway. The bottom surface **545** is parallel to an underlying earth retaining wall. For example, the top surface **540** may run parallel to a roadway above the precast leveling segment **500** that slopes from the left side **560** to the right side **550** whereas the bottom surface **545** may run parallel to an underlying earth retaining wall that does not slope. In this example, the top surface **540** is not parallel to the bottom surface **545** but the bottom surface **545** is perpendicular to the front surface **530**. Continuing the example, the height of the left side **560** is greater than the height of the right side **550** to facilitate the top surface **540** running parallel to the roadway above. Allowing the top surface **540** to run parallel to the roadway and the bottom surface **545** to run parallel to the underlying earth retaining wall prevents the need to slope the underlying earth retaining wall.

The horizontal stem **590** extends outwardly from a rear surface **535** of the front portion **320**. The horizontal stem **590** comprises a triangular portion **310** extending left and right from the top surface **570** of the horizontal stem **590**. The triangular portion **310** of the horizontal stem **590** helps capture the weight of the surrounding backfill soil to add resisting force by means of downward weight on the precast leveling segment **500**. Two open boxed cavities **520** are cast into the lower section of the precast leveling segment **500** to allow lifting for placement. The alignment seat **165** has right and left aligning elements **370** that align the leveling segment to an underlying earth retaining wall.

FIG. **13** depicts an isometric view to illustrate that the triangular portion **310** of the horizontal stem **590** covers approximately 50% of the overall area of backfill soil that is available to provide weight for overturning resistance. The triangular portion **310** allows a reduced horizontal coverage area and saves precast concrete area and/or volume.

In reference to FIG. **14**, a cross section **600** of a sloping elevated roadway grade **420** is shown sitting on top of an earth retaining wall. The elevated roadway grade **420** slopes toward the viewer of FIG. **14**. The top surface **540** of the front portion of the precast leveling segment **500** slopes toward the viewer of FIG. **14** parallel to the elevated roadway grade **420**. One of two protrusions **170** is shown. The protrusion **170**, along with the other, nonvisible protrusion, locks into the precast segment below. A horizontal stem **590** comprises at least a triangular portion **310** and square holes **240**. For installation of a precast leveling segment **500**, two square holes **240** are cast into the precast leveling segment **500** for lifting and hoisting the precast leveling segment **500** into place. A horizontal stem **590** parallel to the traffic barrier above is required to transfer downward vertical pressure from a traffic barrier above to the horizontal stem **590** below the precast leveling segment **500**.

FIG. **15** depicts an elevation view of the front face of the earth retaining wall. A leveling course **505** of precast leveling segments **500***a*, **500***b*, and **500***c* makes up the designated row below the elevated roadway grade **420**. Although many precast leveling segments are depicted, the leveling course **505** may comprise one or more precast leveling segments. The top surfaces **540***a*, **540***b*, and **540***c* of the precast leveling segments **500***a*, **500***b*, and **500***c* slope parallel to the sloping elevated roadway grade **420**. Thus, the front surface heights of left edges **560***a*, **560***b*, and **560***c* and right edges **550***a*, **550***b*, and **550***c* of each of the precast leveling segments **500***a*, **500***b*, and **500***c* may increase or decrease relative to the precast leveling segments **500***a*, **500***b*, and **500***c* immediately to the left or right as the elevated roadway grade **420** increases or decreases. The precast leveling segments are in an order that maintains a predefined distance between the elevated roadway grade **420** and the top surfaces **540***a*, **540***b*, and **540***c*. For example, the distance between a point at the top of the left edge **560***a* and a point **422***a* on the roadway that is on a line parallel to the left edge **560***a* equals the distance between a point at the top of the right edge **550***a* and a point **422***b* on the roadway that is on a line parallel to the right edge **550***a*. In one

embodiment, the first front surface height of the right edge **550***a* of a first precast leveling segment **500***a* is greater than a second front surface height of the right edge **550***b* of a second precast leveling segment **500***b*. Therefore, the top surfaces **540***a* and **540***b* slope parallel to the elevated roadway grade **420** above the leveling course **505**. The precast leveling segments **500***a*, **500***b*, and **500***c* are aligned such that the height of the right edge **550***a* of the first precast leveling segment **500***a* is within a predefined delta of the height of the left edge **560***b* of the second precast leveling segment **500***b* to ensure a gradual slope parallel to the elevated roadway grade **420** above. In alternative embodiments, the height of the left edge **560***b* may be greater than the height of left edge **560***a* when the elevated roadway grade **420** increases slope or the height of the left edge **560***b* may be less than the height of left edge **560***a* when the elevated roadway grade **420** decreases slope.

In FIG. **16**, a side view of a precast leveling segment **500** is shown. Shown is a front portion **520**, horizontal stem **590**, and alignment seat **515**. The front portion **530** comprises a front surface **525**, a top surface **540**, a rear surface **535**, and a bottom surface **545**. The horizontal stem **590** attaches to the rear surface **535** of the front portion **520**. The top surface **540** slopes downward, with a greater height of the left edge **560** than the height of the right edge **550**. The horizontal stem **590** comprises a top surface **570** and a triangular portion **310**. Two square holes **520** are cast into the horizontal stem **590** of the precast leveling segment **500** for lifting and hoisting the precast leveling segment **500** into place. The alignment seat **515** comprises at least lower aligning elements **370** that extend below the horizontal stem **310** to lock in to the earth retaining wall system below. The lower aligning elements **370** may be locking lugs.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible non-limiting examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be included herein within the scope of this disclosure and the present invention.

Therefore, at least the following is claimed:

1. A precast leveling segment placed above a top portion of an underlying concrete earth retaining wall and below a sloped roadway, the precast leveling segment comprising:

a front portion comprising a front surface, a rear surface, a top surface, and a bottom surface, wherein:

the front surface is parallel to the rear surface;

the top surface is parallel to the sloped roadway;

the bottom surface is perpendicular to the front surface; and

the top surface is nonparallel to the bottom surface;

a horizontal stem extending outwardly from the rear surface of the front portion and extending from the top surface to the bottom surface, a lower portion of the horizontal stem comprising a triangular portion extending outwardly from a first side and a second side of the horizontal stem, and the triangular portion of the horizontal stem comprising one or more cavities disposed along a face of at least one side of the triangular portion; and

an alignment seat extending along at least a portion of the horizontal stem, the alignment seat being configured to lock into the underlying retaining wall system,

wherein the underlying concrete earth retaining wall is not level with the sloped roadway, and

wherein the precast leveling segment is situated between a traffic barrier segment and the underlying concrete earth retaining wall, at least a portion of the traffic barrier segment being above the sloped roadway.

2. The precast leveling segment of claim **1**, wherein the front surface has a left edge and a right edge.

3. The precast leveling segment of claim **2**, wherein:

a left edge of the front portion is perpendicular to the bottom surface;

a right edge of the front portion is perpendicular to the bottom surface;

the left edge is non-perpendicular to the top surface; and

the right edge is non-perpendicular to the top surface.

4. The precast leveling segment of claim **2**, wherein a left edge height of the left edge is nonequal to a right edge height of the right edge.

5. The precast leveling segment of claim **2**, wherein a left edge distance between a left edge top point on the left edge and the roadway is equivalent to a right edge distance between a right edge top point on the right edge and the roadway.

6. A leveling course comprising a series of a plurality of precast leveling segments defined in claim **1**.

7. The leveling course of claim **6**, wherein the series of the plurality of precast leveling segments comprises a plurality of the precast leveling segments, the respective one of the plurality of front surfaces of each one of the plurality of precast leveling segments aligned adjacent and parallel to other ones of the plurality of front surfaces of the plurality of precast leveling segments.

8. An earth retaining wall comprising:

at least one precast leveling segment, comprising:

a front portion extending from a top surface to a bottom surface, the front portion comprising at least a left edge and a right edge, wherein a right edge height of the right edge is nonequal to a left edge height of the left edge, and the top surface of the front portion being parallel to a sloped roadway situated above the at least one precast leveling segment;

a horizontal stem extending outwardly from a rear surface of the front portion, a lower portion of the horizontal stem comprising a triangular portion extending outwardly from a first side and a second side of the horizontal stem, the triangular portion comprising one or more cavities disposed along a face of at least one side of the triangular portion; and

an alignment seat extending downwardly from at least a portion of the horizontal stem;

at least one precast standard segment situated below the at least one precast leveling segment, a top surface of the at least one precast standard segment being parallel to a bottom surface of the at least one precast leveling segment and being nonparallel to the top surface of the at least one precast leveling segment; and

at least one traffic barrier segment disposed above the at least one precast leveling segment, at least a portion of the at least one traffic barrier segment being above the sloped roadway.

9. The earth retaining wall of claim **8**, wherein the alignment seat joins the at least one precast leveling segment to the at least one precast standard segment of the earth retaining wall.

10. A leveling course comprising a plurality of the at least one precast leveling segment of claim **8**, wherein the respective front portion of each one of the plurality of precast leveling segments is aligned with the respective front portion of other ones of the plurality of precast leveling segments.

11. A leveling course comprising at least one precast leveling segment, the at least one precast leveling segment comprising at least:

a top surface parallel to a sloped roadway situated above the precast leveling segment;

a bottom surface parallel to a top precast block segment of a substantially level underlying earth retaining wall situated below the precast leveling segment; and

a horizontal stem extending outwardly from a rear surface of a front portion of the at least one precast leveling segment, wherein the horizontal stem extends from the top surface to the bottom surface, a lower portion of the horizontal stem comprising a triangular portion extending outwardly from a first side and a second side of the horizontal stem, and the triangular portion of the horizontal stem comprising one or more cavities disposed along a face of at least one side of the triangular portion,

wherein the at least one precast leveling segment is situated between a precast roadway barrier segment and the substantially level underlying earth retaining wall, and

wherein a top plane of the substantially level underlying earth retaining wall is nonparallel to the sloped roadway.

12. The leveling course of claim 11, wherein the top surface is nonparallel to the bottom surface.

13. The leveling course of claim 11, further comprising a plurality of heights corresponding to a distance between a plurality of points on the top surface and respective ones of a plurality of points on the bottom surface.

14. The leveling course of claim 13, wherein each one of the plurality of heights equals a distance between the bottom surface at a bottom surface point corresponding to a respective one of the plurality of points along the top surface and the roadway at a roadway point corresponding to the respective one of the plurality of points on the top surface.

15. The leveling course of claim 11, wherein the at least one precast leveling segment further comprises an alignment seat comprising at least one aligning element extending downwardly from at least a portion of the horizontal stem.

16. The leveling course of claim 15, wherein the alignment seat interlocks the at least one precast leveling segment with at least one precast segment of the earth retaining wall.

17. The earth retaining wall of claim 8, wherein individual barrier segments of the at least one traffic barrier segment comprise:

a front barrier portion comprising a front surface, a rear surface, a first side surface, and a second side surface, wherein a first portion of the front surface is situated above the sloped roadway and a second portion of the front surface is situated below the sloped roadway; and

a rear stem extending outwardly from the rear surface of the barrier segment.

18. The earth retaining wall of claim 17, wherein the individual ones of the at least one traffic barrier segment further comprise a vertical node protruding outwardly from the first side surface of the front barrier portion, and a groove situated within the second side surface of the front barrier portion such that the vertical node of a first traffic barrier segment is configured to interlock with another groove of a second leveling barrier segment situated adjacent to the first traffic barrier segment.

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